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ABSTRACT

Directed to the class or individual with limited film making equipment, this paper presents a "hands on" guide to the production of animated cartoons. Its 14 sections deal with the following topics: understanding animation; choosing subject matter for an animation; writing a script; getting the timing right; choosing a camera and projector; developing a cartoon character model sheet; assembling materials and making job assignments; building a simple machine that allows the director to preview the animation; developing a filing system for the animation drawings; choosing backgrounds for the animation; animating lip movements; photographing cartoons; editing the film; and adding sound to the film. The paper concludes with lists of learning objectives and review questions for each section of the paper. Charts and illustrations are included in several of the sections. (GT)

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Animation in the Schools

By

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Preface

The books now available on animation, for the most part, are not directed toward the classroom and most of these books have little real application within a limited budget or limited equipment. Many of the texts are so technical and require such technical equipment they have little to offer the amateur or classroom situation.

What is presented here is a "hands on" guide for the class or individual with limited equipment. The equipment mentioned is readily available in most schools or available for rental through local camera stores. The text is presented in a step-by-step flow of ideas and methods necessary for the completion of a semester or year long project.

The information given in the Animation Table is the result of much experimentation and was not taken from any text, it is, therefore, not an absolute, but intended to be a guide for the amateur, as is also the Walking Cycle.

I can not and do not pass myself off as a professional animator, but what I do profess is a keen interest in animation and the experience of having worked with hundreds of students within numerous animation projects using limited equipment. I have tried to simplify a very complex subject, and if you find this text lacking in certain areas it is because of the vastness of the subject. It is for this reason I have suggested reading certain books mentioned in this text.

M. L. G.

CONTENTS

		Page
	Introduction	1
I.	What is Animation?	2
II.	Where Do We Begin?	3
III.	How Do You Write An Animation Script?	6
IV.	How Do You Get The Timing Right?	9
V.	What Kind of Camera And Projector Do I Need?	12
VI.	How Do You Develop A Cartoon Character Model Sheet?	14
VII.	How Do We Begin the Work?	16
VIII.	How Can We Be Sure Of The Animation?	21
IX.	How Do We Keep Track of All The Cels?	25
X.	What Are The Different Kinds of Backgrounds?	26
XI.	How Do We Animate The Lip Movement?	28
XII.	How Do We Photograph Our Cartoon?	29
XIII.	How Do We Edit The Film?	32
XIV.	How Do You Add Sound To The Film?	32
	Learning Objectives	34
	Chapter Review Questions	37

Introduction

The amateur animator is often at a disadvantage, due in part to a lack of knowledge and more often because of a lack of proper equipment. Quality animation is possible with only a few inovations in equipment design.

Animating a cartoon movie is a difficult and demanding process and is so involved that a person can loose himself in the very process alone and find himself fascinated by the results of his labor.

I have been involved with animation for about a decade as an art teacher in a public high school. For me, animation was the answer to a desperate need. A lack of art funds sent me looking for projects related to art, which could provide new sources of revenue. Animated cartoon movies shown throughout the school system, with a small admission, provided not only needed funds but also proved to be an ideal art education project for the students involved.

Animation, as a group project, requires a division of labor, and as any teacher knows, students come in all levels of ability. The trick in animation is to place each person on the job that best suits his skills. In producing a cartoon film the best artists should work on backgrounds and animation. Other jobs that are equally important but require less skills are painters, inkers, and the people who help photograph the film.

A good director is of paramount importance.

If animation is done by an individual then he must assume all the roles listed above. If an individual makes an animated cartoon he must have the ability to control all factors and at the same time critique all aspects of the production.

It is my purpose in this writing to state as simply as possible the methods for producing an animated cartoon movie which may be followed by students or the amateur film maker.

I. WHAT IS ANIMATION

Animation as defined by Webster is, "1. An animating or being animated. 2. life 3. vivacity 4. the making of animated cartoons." The first and last definitions given here shall be the context of our references during this writing, so that we may refer to animation as the complete process or as the division dealing with the actual drawing of each character in a sequence of movements.

Animated cartoons have been largely made possible by the development of the movie camera, film, and projector, but animation was in existence long before then. Early devices for viewing animation drawings, such as the Zoetrope, led to other machines such as Edison's Kinetoscope. In each of these devices the basic idea was the same, animation, drawings of a movement in sequence, was viewed through shutter like slots allowing the machine to advance to the next drawing in the sequence. The time element, in the viewing of one drawing to the next, as well as the shutter were so designed to give

the impression of a single picture which has movement. This is the basis for motion pictures today.

Basically we can say that animation depends upon the design or character to be animated retaining about the same size, shape, and color in a drawing to drawing sequence. The degree of change in the drawings necessary may vary as the time and action vary. The color may vary as the mood of the character varies, such as bashful red, scared white, or frozen blue.

The sound movie camera operates at a speed of 24 frames per second. This simply means for each second of filming time the camera has taken 24 different pictures at regular intervals. Silent camera and projectors operate at 16 to 18 frames per second. Sound reproduction required the extra speed during the time these film speeds were standardized, but given todays technology a slower speed could become the future standard.

In animation it is important to consider the number of FPS (Frames per second) when planning the animation action. Again consider that animation is drawings in sequence designed to work within the 24 F.P.S. motion picture speed when used with a sound track.

II. WHERE DO WE BEGIN

An animated cartoon movie must first begin with a basic concept of what the film should be. Will it tell a serious story or will it be simply comical? Will it be intended for an audience of elementary age children or will it be made to entertain an older audience? Will it be made to fit an existing

sound recording or will the recording be added to the finished film? All these questions and more must be answered, before starting on the script. The basic idea should then be worked out somewhat like a comic strip in what is called the story board. Each single panel should contain the audio (sound) with an illustrated rough sketch (video) in that panel of the idea expressed of the audio for that panel. In this way the audio and the video will agree.

I can not select your subject matter for you so I would like to relate to you my experiences dealing with various types of animated cartoon films, which may help you in your selection. My students and I have been involved in many different types of cartoon films such as: Scrooge, a fifteen minute production of a very serious nature, The Streak, a 3 minute production which was a comical film, based on Ray Stevens hit record of the same name. Other films were made to illustrate children's stories such as Rumpelstiltzskin, The Pied Piper, and The King's New Clothes. Some films were made to utilize the dramatic recordings available as background music such as; The Lion Hunt was made to fit the theme music of The Good the Bad and the Ugly; the film Harry Haskill, Private Eye, was made to fit the theme music of Clockwork Orange. In each of these films there was a basic approach which distinguished it from other films. We have made films other than those listed above, but I included each of these because of their own unique approach or problem.

The most popular cartoons, those which have endured through the test of time, have been the comical presentations. The

cartoons most enjoyed by high school students have been those made to illustrate a hit record such as Gitarzan, or The Streak. I have found that it is better to do a short good production than to do a long poor production. This is not to say that the film Scrooge was not good, but it did have dull spots where the scenery had to carry the whole story. This method is referred to as limited animation. I much prefer as much animation as possible.

If you decide to animate a popular record it is advised to obtain permission from the recording artist or his manager. Background music is usually ccnsidered only a small part of the total process and usually will not require permission on a local showing, but again to be certain of your legal position a letter of permission from the recording artist would be advised. Most recordings have the name of the studio and the location of the studio on the record. The studio will pass your request on to the recording artist.

The obvious advantage of using a comical popular recording is that it has been proven to be popular with the public. It also gives a good working script from which the final script can easily be prepared. Most of all, it is professionally made of a quality far beyond that which is possible by the amateur. A good recording will help to carry the animation, so that the marriage of these two will give a good product. In the process of animating a prepared sound track, the animation is made to match the sound track.

If you decide to write your own script you may choose to write the script first, make the film to match the script, and then to record the sound on the finished film. In such a case the animation is made to match the script and the sound is made to match the film. This process seems to be most suited to the serious story type of cartoon films.

III. HOW DO YOU WRITE AN ANIMATION SCRIPT?

Writing a script for a cartoon movie is much like writing a script for a play except it is much more detailed and the time element is very critical. A good working script should be divided into three verticle divisions. Under the first division will be the video or visual action. Under the second division will be the time element in seconds and frames needed for that time slot. The third will be the audio or sound, which will include the frame count above each word and the lip movement for each word to be spoken. Horizontal divisions of the three parts mentioned above will be called Scenes, so that each scene will include Video, Time, and Audio corresponding divisions.

Scenes are basically changes of scenery, place, camera angle, or camera shot. In animation the maximum time a single scene should occupy on film would be about five seconds or 120 frames before changing to a different scene or camera angle. The video should always match what is found in its corresponding audio.

In the video division should be a description of the visual image required, as well as a description of the backgrounds and the animation required of the character or characters.

If you are writing your own story you should be concerned about many other factors such as: characters, plot, sub-plot, a building up to a story climax, the release, and another build up to a final story climax, a constant interweaving of the characters throughout the story, local color, dramatic presentation, and humor. You should always keep in mind that action is the most necessary ingredient and that repetition of animation with a change of backgrounds will help to reduce the amount of animation paintings or cels required to make the film. It is for this reason, if you are selecting a popular recording as the basis for your cartoon, you should also look for good repetition.

Whether you write your own story, adapt a popular story, or use a popular record, the final script should be the blue-print for all art and filming productions.

Oh-My Goodness By Martin Greer

Video	Time Frames	Audio
Scene (1) (a) Open up-medium close-up of man thinking	(4 sec) 96 frames	Man: I was just sitting there in my easy chair, watching my favorite T.V. show.
(b) Zoom out slowly to show all family	(6 sec) 144 frames	Man: Just me and my wife and all six kids, I'd like you all to know.
(2) Family going up stairs (long shot)	(6 sec)	Man: That the show was fine and then came the time to get the kids up to bed.
(3) Man & Wife tucking children in bed (medium shot)	(6 sec) 144 frames	Man: So we tucked them in and settled down again, then this is what my wife said,
(4) Man and wife in bed (medium shot) (wife speaks)	(5 sec) 120 frames)	Wife: Lip: D B, A D, B C, D, B C, A B C B, Frames: 4,4, 4,4 4,4, 8, 4,4, 2,2,2,2, Audio: Ive been sick in the mornings C D C D B,D H, B C, B C 4,4 12 4,4 4,4, 4,4 4,4 lately, hun, and I'm craving the D B C, A C B 4,4,4, 3,3,2 strangest food,

A good script should have good action. Nothing can kill a cartoon film quicker than a lack of good exaggerated movement. If a woman hits her husband with a frying pan, be sure the action is exaggerated with the woman coming up off of the floor and the action followed through by the man being flatened and made shorter in height. The pan should ring with a deafening sound, which may cause the characters to vibrate.

The final script should be duplicated and a copy given to each of the people working on the cartoon film.

Lip movement is determined by looking into a mirror and pronouncing each word carefully. When you pronounce the words, observe closely the changes in your own mouth opening and record this on the script according to A, Completely closed, to D, which is the greatest mouth opening. The number of frames for each word is determined by the timing mentioned in the next chapter.

IV. HOW DO YOU GET THE TIMING RIGHT?

If you write your own story and script, timing may not be as critical as matching your cartoon to a recording. In either case there are some basic procedures to make sure the timing of the video matches that of the audio.

When writing your own story and script most of the action timing is not critical, but the lip sync is critical. Most

speech moves at a fairly regular pace of about four words per second. Each word would occupy six frames on the movie film. In most cases this timing will be suitable if you add the sound after the film has been edited. The action taking place between the speaking parts should vary in film length according to what is taking place. A guide to the action will be covered under a discussion of animation. Try to plan the scenes of action no less than two seconds, nor more than five seconds in time duration in your working script.

If you are trying to match the video to a sound recording, timing becomes critical. There are several ways of matching the video to a recorded sound track. I will mention a couple of ways the amateur may go about this with only limited equipment.

The first step in obtaining a working sound script for a recording is to obtain a complete written sheet of music or by listening closely to the record and writing the words down on paper. Having the words written down, the next step is to divide these words into five second intervals and, if possible, one second intervals, by listening, to the record with a stop watch in hand.

Two people are usually required to accomplish this but it can be done by one person. This will necessitate listening to the record many times. Having divided the script into one second intervals you can make rough guesses using the movement guide for animation and the six frames per word guide. You can simple divide the number of words in that one

second space into twenty-four, which will give you the number of frames for each word. When counting the words, be sure to count long words as two words and, pauses as a word or more depending upon the time element involved. The final script should indicate the number of frames each word should occupy on the finished film as well as the number of frames for the action required.

Another method for dividing the sound into one second intervals involves making a magnetic sound track on film that has been made similiar to a universal lead film, and then using the written sheet music as a guide to marking the words corresponding on the sound track to the visual one second image. In other words, by filming every twenty-four frames of a number in its natural order of succession, a visual image is put on a magnetic sound test film, which can be used as a visual guide. The sound is recorded on this sound test film and played back on a sound projector. You may then see the seconds change from one to two, to three...as you listen to the recorded sound. By marking the script of the one second changes you should obtain very accurate one second intervals on the script. Using the methods described earlier you may then obtain what will happen each frame.

It is important to remember that many recording devices, no matter how good of condition, may run at slightly different speeds. It is for that reason you should always use the same equipment, within a close period of time if possible, to insure a good timed sound script and recording.

The professional animation studio uses what is known as a sychronizer. The use of such a machine would greatly simplify the problem of obtaining a frame count of words, sentences, music, pauses, and action. Since most amateurs do not have use of such equipment they must use other methods.

V. WHAT KIND OF CAMERA AND PROJECTOR DO I NEED?

Your choice of camera and projector may vary according to your needs and how much you are willing to invest. For the amateur, sound sync. may not be necessary where the sound is only background music and lip sync. is not involved in the animation, but for most cartoon productions sound on the film is a necessity.

Our first cartoon was filmed on the 16 mm camera owned by the athletic department of our school, and the sound was recorded on a tape recorder. When shown, the film was projected on a school 16 mm projector and we attempted to match the audio to the video. We soon discovered it was near impossible to obtain the sync. we had desired, but I would advise this method where the animation does not require a close sync. with the sound. No matter what method of production you choose, the camera must be able to take single frames. Perhaps you have such a camera available to you. In such a case you may be able to do a great deal without much investment.

Other 16 mm equipment may be available to you without cost, especially if you teach in a school system, or it may be available for a small rental fee. Most T.V. Stations use 16 mm magnetic sound as the filming part of their news programs. If you can arrange a suitable time, they may be persuaded to allow you to use their equipment and even borrow a magnetic sound projector for the final showing to your audience. If this is possible, you may then film your cartoon using a 16 mm camera and use color 16 mm film with a magnetic sound track. Many camera stores will arrange for you to rent such a projector if it is not available to you otherwise. It is important to know for certain what kind of projector you will be able to use before starting your film. A magnetic sound track on 16 mm film will give you an excellent syncronization of audio to video.

Another process of animation filming involves the use of a Super 8 camera and projector. I personally prefer the use of Super 8 equipment, because of the many automatic features, a good sync., the ease of editing, and zoom lenses which help to give a more professional look to the finished film. If you decide to use Super 8, then purchase a camera which will take single frames. There are several models available in Super 8, which will take single frames, made by G.A.F., Kodak, Bolex, and many others. Your camera salesman in a local discount store

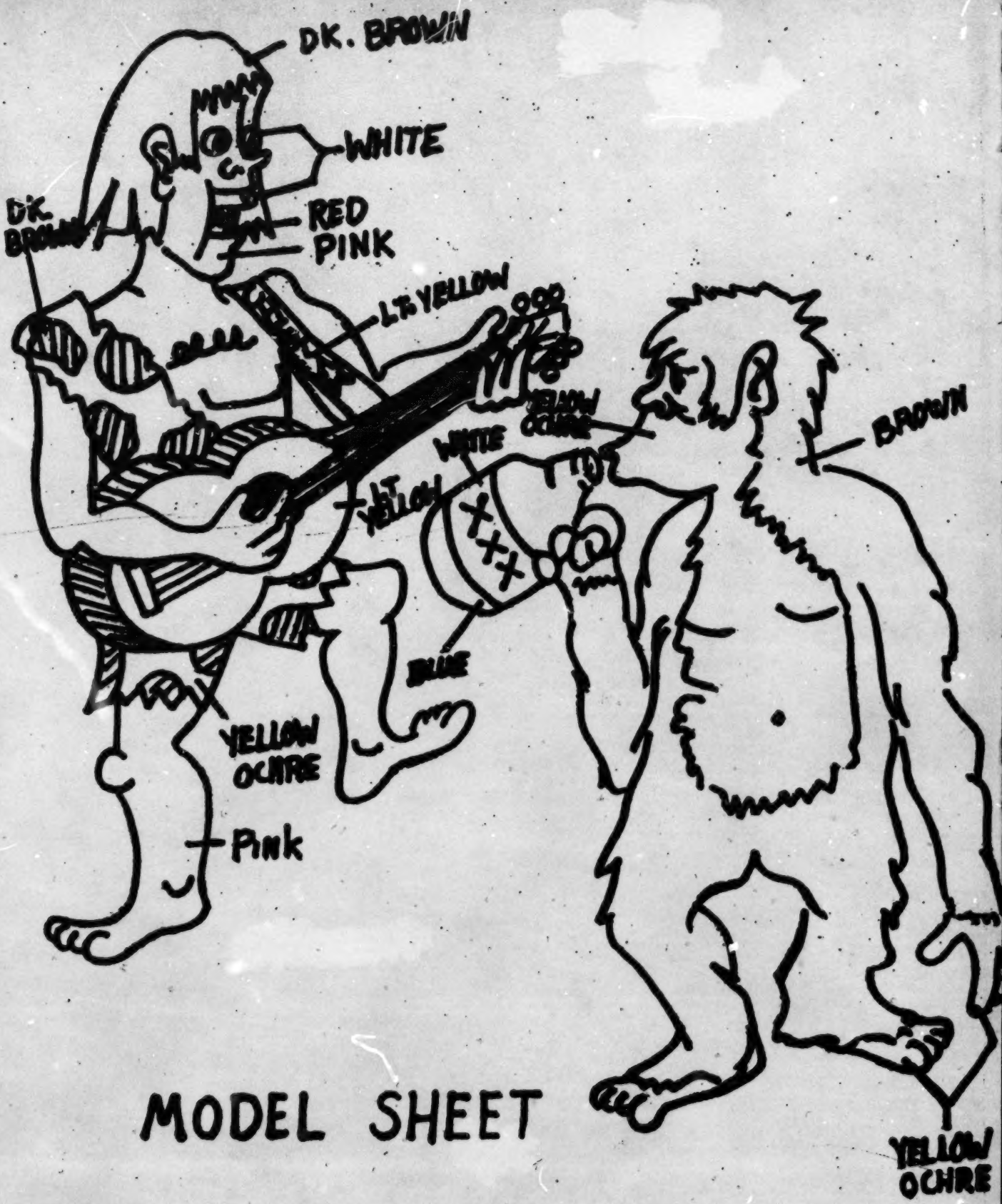
or camera shop will gladly help you in the selection of your camera. Sound stripping service, the process of adding a magnetic recording track to the finished film, is available at your local camera shop through Eastman Kodak. After the film has a sound strip, you may then record the sound on the film using your projector, much like using a tape recorder.

There are many Super 8 sound projectors now on the market such as Bolex, Kodak, and many other brands. The important thing to remember in purchasing a Super 8 sound projector is to be sure you can record through the projectors sound system. If it doesn't have a microphone, it is of little value to you.

VI. HOW DO YOU DEVELOP A CARTOON CHARACTER MODEL SHEET?

Since all characters must be standardized for uniform cartoon film identification, model sheets should be developed early to aid in the film animation continuity. You, as the director or teacher, may be the one on which this responsibility will fall.

First of all, the cartoon characters, must fit the parts they are to play, like actors in a stage production each must be made-up to give the audience the feel of the actor's characters and I will try to give you here a brief description of a few main ones.


DK. BROWN
WHITE
RED
PINK
DK. BROWN
LT. YELLOW
YELLOW OCHRE
WHITE
LT. YELLOW
BROWN
BLUE
YELLOW OCHRE
Pink
YELLOW OCHRE

MODEL SHEET

The Cute Cartoon Character - Charles Shultz in his "Peanuts" characters has given the world a cast of cute simple cartoon characters. Notice the simplicity of the cute characters in their two to three heads high physical structure. The height of the entire body from the neck down is about equal to that of the height of the head. There is a uniform happy smile, slightly turned up nose, high forehead, and button eyes that are wide awake. Why is it we like the cute type of character? Maybe it is because the proportions more closely resemble that of a baby or a puppy which compel a universal natural love of all people.

The Hero-Heroine Character Types - Al Capp's characters of Little Abner and Daisy Mae give us excellent examples of hero and heroine cartoon character types. Notice the near human proportions with exaggerations in those areas considered most masculine or femine on the appropriate character. In both characters yo find a narrow waist. Little Abner has an angular muscular body while Daisy Mae's body is drawn with the soft gentle curves of a pin-up girl. Her face is also drawn with gentle curves and the simplicity of a fashion ad drawing. Little Abner's face is drawn with angular lines and a squared off chin. The masculine heavy chin helps to give him the look of a hero.

The Villain - The Classical villain brings to mind a tall black top hat and a dark cape. His back is hunched and his face is long with beady eyes and a long black

mustache. He rubs his hands together in a nervous clinch as if in eager anticipation of obtaining some great wealth by his devilish deeds.

The Comedy Team - Abbott and Costello is the classical example of the comedy team. One short fat dumb character paired with a tall straight man is a team that lends itself to numerous comic situations. Cartoon characters based on the comedy team will help to liven up a cartoon film.

After you have developed the cast of characters, model sheets should be made for each character including as many different views as necessary for the animation situations. These character drawings should be duplicated for each artist involved in the production as should the entire script. The characters should be labeled as to the color desired for the various parts such as hair color, skin color, eyes, and costume color.

VII. HOW DO WE BEGIN THE WORK?

In order to begin the work you now need three things: 1. materials, 2. artists, 3. assignments. You should purchase the materials in plenty of time to be able to complete the cartoon within your schedule. I like to schedule the showing of our cartoon movie the first week in May while starting during the latter part of the preceeding

October. You should not need that much time, but it will give you a month of extra time in case of any filming problems.

Many of the materials you may be able to purchase locally from art supply stores, office supply stores. I prefer to purchase my supplies from large discount art supply companies such as Dick Blick, Galesburg, Illinois, or Nasco, Ft. Atkinson, Wisconsin. I usually order seventy 20" X 50" sheets of .005 clear acetate which I take to the newspaper office and get them to cut it into 16 1/2" X 13" pieces. This leaves me with some scrap pieces which I can always use for other art projects. Since the cels come packed with tracing paper between each cel (clear acetate or cellulose) these sheets of tracing paper are ideal on which to do the pencil animation drawings.

You will need pen staffs and pen points, as well as India ink for the tracing of the pencil animation drawings on to the cels. Be careful not to purchase a cheap brand of India ink as it may not work at all. Triangle Artist Supply as well as other art supply stores may supply you with an India ink made especially for inking on cels. Black felt tip pens by Sharpie are reasonably priced, work extremely well, and eliminate the need for India ink.

Tube type watercolors will be needed for the backgrounds and scenes, which are painted on poster board or

good heavy watercolor paper. These backgrounds are made to fit under the cel of animation and should be the same size of the cel. Scenes for photographic effect, may be much larger, up to 3' X 6'.

Acrylic paint and brushes should finish up the list of required materials. After the cels have been inked and the ink is dry, the cels should be turned over and painted on the back with acrylic paint. Special care should be giver to keep the cels clean.

If a color is needed that can not be purchased in a tube you may mix the acrylic paints necessary in large quantity and seal it in a fruit jar. It is important to maintain the same degree of color in a set of animation in order to avoid the colors flashing like a neon sign on film. Be sure to allow the paint to dry completely before filing the animated cels. Even then it would be a good idea to place the tracing sheets back between the cels.

Knowing the ability of your artists is very important in being able to make the division of labor necessary to accomplish this group project. The director must be one who will make decisions and will stay on top of every aspect of the project. At times he or she may seem to be a virtual slave driver as the director pushes to get the jobs done. The director should be a person who has the respect of the other artists and is capable of completing any part of the animated cartoon if the case should arise. The director

should be aware of all the little details and should be one who will work harder and longer than any other artist involved in the project. The director should love to work on the film above all else, if he or she is to be a success. A good director is one of the strongest aspects in determining the success of the cartoon film.

The background artist should be a good artist and painter. He or she should be able to give a realistic background the color, shading, and perspective of a fine painting while fitting the background to the animation action of the appropriate cels. Perhaps the best art talent should be used to create the backgrounds.

The next most demanding job is that of the animator, some would say it is the most demanding job. The animator must have a sense of movement and what it takes to complete a movement cycle. He must have a sense of the comical and be able to exaggerate what would seem a simple movement. He must above all be able to do the many pencil sketches required of him and do them accurately without a loss of proportion and detail.

The inker must be able to trace the animators drawings on to the cels in simple smooth lines. He must be neat in his work and accurate in every detail. The painter must maintain a neat smooth coat of paint. He must be accurate in the placement of his colors and be careful not to soil the painting or the cel.

The photographers may be many of the people who served in the functions listed above. The photography usually requires several crews consisting of a director, a camera man, and two people to change the cels and or backgrounds.

The assignments of various jobs should be made so that the job load is evenly balanced. In producing our cartoon films I usually have 15 to 20 students involved. Using the fifteen figure, the breakdown of assignments are; one director, three background artists, four animators, two inkers, and five painters. This may seem to be an imbalanced group, but in reality it is very representative of the real work loads. A list of assignments, listed according to each scene, should be made by the director and posted for easy reference.

Before the animators and background artists begin it would be good to advise them to work together closely so that the animation and backgrounds will seem to fit together, especially where action or movement is required. Keep in mind that while the size of the cel is 13" X 16 1/2" the area that will be concentrated upon will be centered in the cel of 8" X 10" size. This means the 2 1/2" on top and bottom and the 3 1/4" on each side of this 8" X 10" area is there only to insure a good picture in case of parallex problems in photography. All cameras have some parallex problems, even with a through the lens viewfinder.

VII. HOW CAN WE BE SURE OF THE ANIMATION?

A long time before the pencil animation drawings are inked on the cels, the animator wants to know that what he has drawn will look good on film, and if he then wants to make the necessary corrections. Animation studios often make films of these drawings to form what they call "the pencil test," but such test films involve a great deal of time and added cost that is not necessary with the use of a Zoetrope.

The Zoetrope, was a toy of the 19th Century and the forerunner of the modern motion picture projector, but I have adapted the design to create a simple machine capable of giving a clear animated image moving at about the same speed as found in modern motion picture projectors. My Zoetrope is designed to work on top of a record player turntable and be capable of handling full size animation characters in about a two inch wide space by four inches tall.

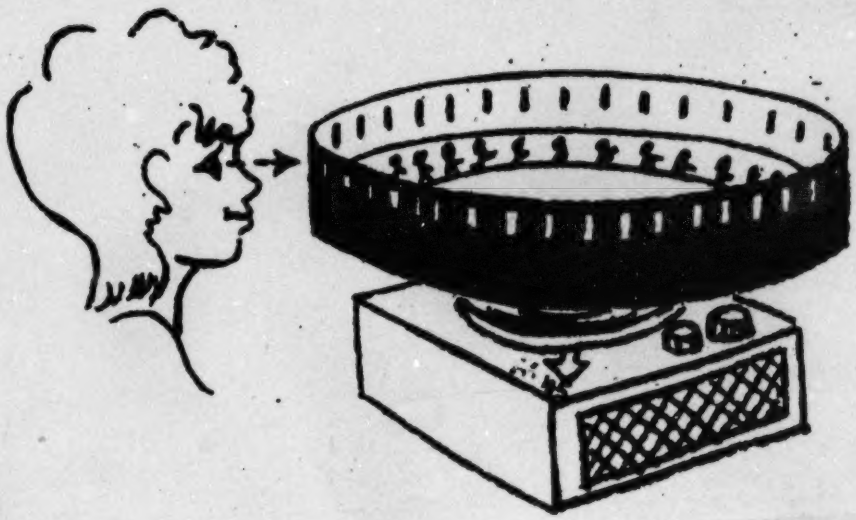
Basically the Zoetrope is a cylinder in which are cut tall thin slots in equal distances around the wall of the Zoetrope. Each one of these slots corresponds to a single animation drawing and works like a small shutter.

I have built several models of the basic Zoetrope design, two of which have proven to be of great value. I shall describe them here to you and allow you to choose which one you would care to build.

LIP MOVEMENT

D C B A

THE ZOETROPE



The large Zoetrope is based on 32 drawings to be revolved at 45 rpms. This figures out to be 1440 per minute, which is the same as 24 FPS (frames per second) or the same speed at which the sound motion picture projector operates. This Zoetrope is made using corregated cardboard as the base which has been cut in a circle of 27" diameter. This 27" circle is then marked into 32 equal angles. This is done by dividing the circle into 2, 4, 8, 16, and finally 32 equal angles. Next attach a strip of poster board to the circumference of the circle of about seven inches tall and draw verticle lines on this to correspond to each of the 32 lines radiating from the center of the Zoetrope. Next, make small slots 1/8" wide by 1" tall slightly below the top of the outer poster board ring, corresponding to each of the 32 verticle lines. Paint the outside of the Zoetrope black. Elevate the Zoetrope on sewing thread spools of equal height.

To make an animation strip of 32 drawings first draw the character to be animated, and then make a paper strip 5 inches tall and about 94 inches long. Fit this paper strip tightly around the outside of the wall of the Zoetrope and tape the loose paper ends together. Next, mark the paper strip from right to left, 1 to 32 centered on the viewing slots. These numbers will serve as a guide for the animation to be drawn later. All animation is from right to left on the Zoetrope because of the direction the turntable of the record players revolves is in a clockwise direction. The animation strip will be viewed, through the outer ring

1 3

5
7

9

11

13 15

slots, inside the Zoetrope. The animated characters are drawn centered between the numbered marks and inked, using a black felt tip pen. This Zoetrope is also a valuable tool in training students in animation.

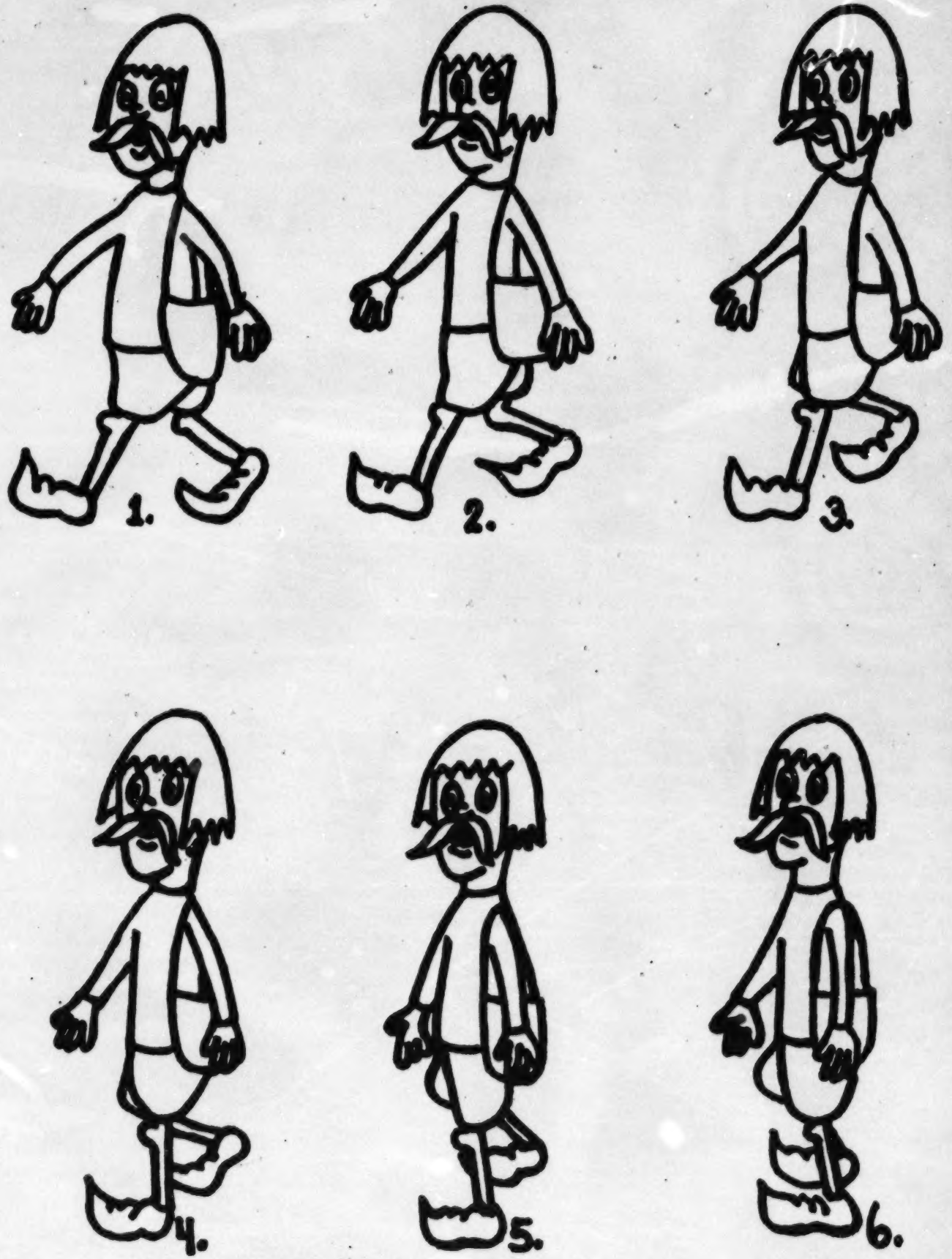
A far simpler and smaller Zoetrope will give nearly as good results as the large one mentioned above. It is based on 12 drawings to be revolved at 78 rpm, which is about the same as 16 FPS. or the speed a projector runs on silent speed. If you are tempted to make this Zoetrope, remember the action will be speeded up by about 50% when viewed on sound film at 24 F.P.S.

I like the small Zoetrope because of its simplicity and size. To build it all you will need is a pencil, poster board, a record, ruler, tape, glue, protractor, razor blade, and scissors. Take a long playing record and trace its shape off on to poster board including the center hole. Cut this out and then divide the circle into 30 degree angles. Draw the angles radiation from the center of the circle. This will divide the circle into twelve equal angels. Make a four inch tall wall of poster board around the circumference of the circle. Mark off verticle lines corresponding to each of the twelve lines radiating from the center of the circle and cut tall thin slots 1/8" X 1" about one inch down from the top of this outer ring. While it is not a necessity, it is advised to paint the outer ring black. This will help to give a better image while viewing the animation on the Zoetrope.

Instead of making a strip of paper to go inside the Zoetrope, try doing the animation on twelve small 2" X 4" strips of paper and using paper clips to hold them to the Zoetrope. Again, it is advised to ink the animation using a black felt tip pen. Remember the animation is from right to left.

I would like to point out to you, while we are dealing directly with the problems of animation, that most animation studios employ what is known as double frame photography, which cuts down considerably on the amount of animation needed for a cartoon. What it simply means is that you do not need to do every other animation drawing if the photographer will take two pictures in succession of each of your drawings on the cel.

I would like to recommend for further study of animation that you purchase a book titled, "Animals In Motion." It will help considerably in many types of animation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Step Guide

1. Arm swings with opposite foot.
2. Second step starts one frame before first step is finished.
3. Height of character varies--highest point is 4 and 12.

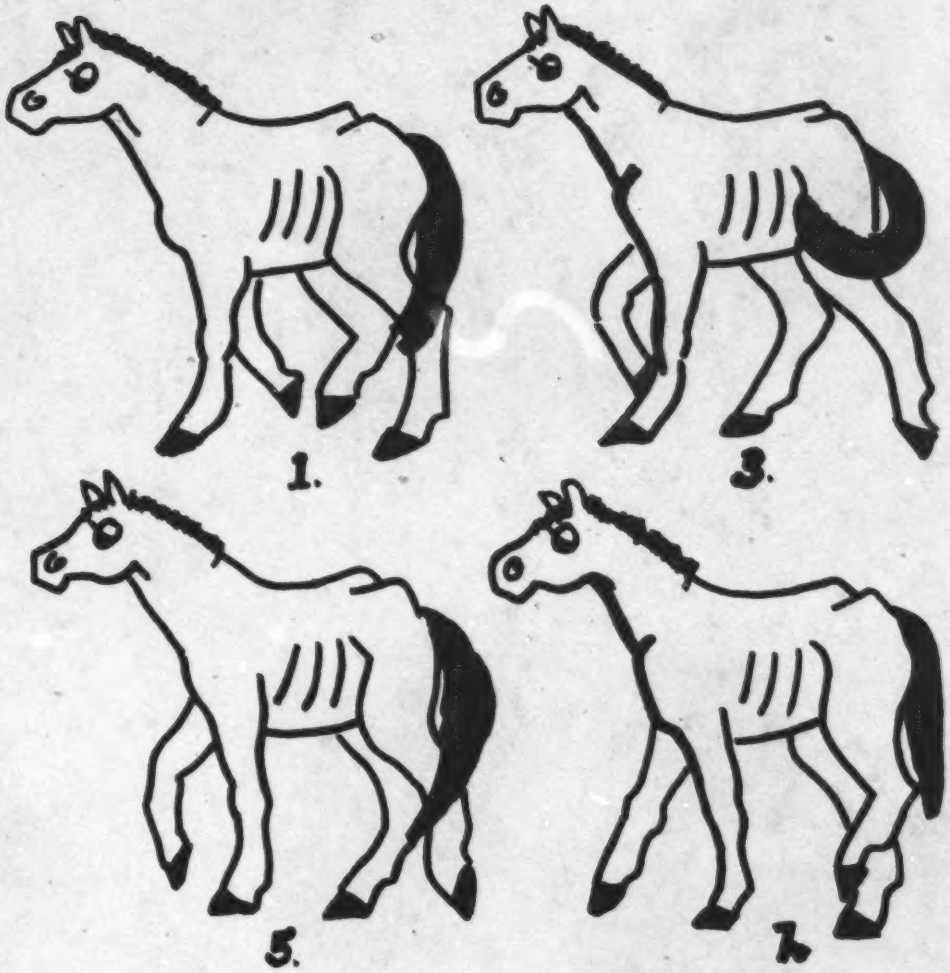
16.

ANIMATION TABLE

ACTION (24 FPS)	DRAWINGS NEEDED (USING DOUBLE FRAME PHOTOGRAPHY)	FRAMES
Jump Up	8	16
Down	8	16
Slow Walk (2 Steps)	16	32
Run (2 Steps)	12	24
Fall Down	6	12
Get Up	12	24
Kick Up	8	16
Down	8	16
Fast Walk (2 Steps)	12	24
Arm to Mouth Movement	6	12
Bend Over	6	12
Turn Left to Right	15	30
Bird Wing Flaps (One Cycle)	8	16
One Word (Lip Movement Count)	3	6

IX. HOW DO WE DEEP TRACK OF ALL THE CELS?

A filing system must be developed early so that, when you begin to find your desk cluttered with several hundred animation drawings or cels, all hope is not lost. The filing system should begin with the animators and continue through all aspects of the film. Each drawing of animation should be labeled in the upper right hand corner as to the scene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number and the sequence number of the individual drawing. The inkers will pass this information on when they ink the cel by placing a small strip of masking tape in the upper right hand corner of the cel with the same information written on it. After the cel has been inked the painter will know to turn the cel so this mark is in his upper left hand corner to insure he is painting on the back of the cel. After the paint is dry, the marker will be removed from the front of the cel and placed on the painted portion of the back so it can not be seen from the front side. All cels should be placed in numerical order with tissue paper between in folders according to scenes and the folders labeled accordingly.

X. WHAT ARE THE DIFFERENT KINDS OF BACKGROUNDS?

There are many types of backgrounds such as the stationary background, the horizontal movement background, the vertical movement background, the animated background, and scenes.

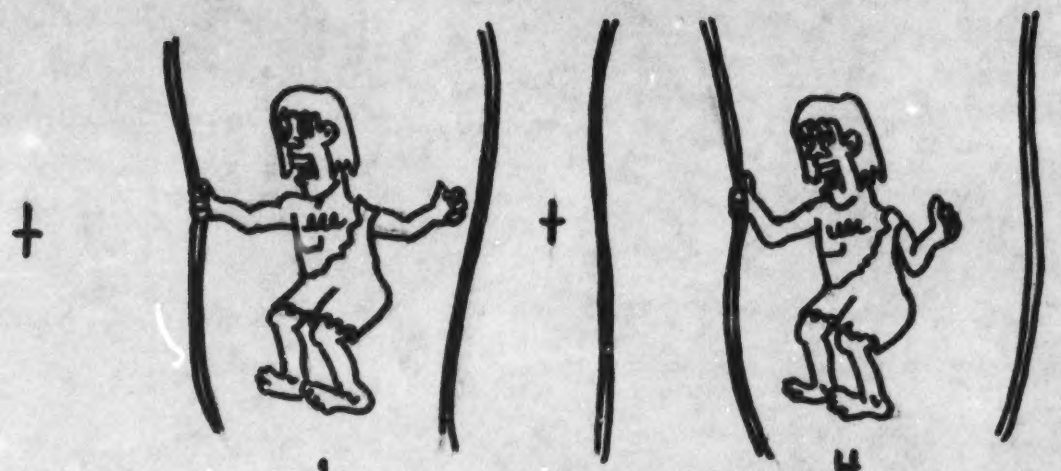
Let me first of all state the difference between scenes and backgrounds. A background is meant to be photographed with animation or cels placed over it, while a scene may not be used with the animation directly. Limited animation often uses the scenes to fill in between the actual animation times. By making the scenes large, up to three feet by six feet size, the photographer may use his camera to zoom in,

pan across, zoom out and otherwise use up film time without the use of animation. Backgrounds are not used for such a purpose, but to enhance the animation by providing the setting for the action.

The stationary background is similar to a painting in perspective. It is the same size of the cel and remains in place behind the cels during the filming process. It is the simplest type of animation background. One background of this type may serve hundreds of cels in the filming process.

The horizontal background is 13 inches tall and usually about three feet in length. The horizontal background is usually used with a walking or running cycle. In this type of animation the character walks or runs in place, while the background is moved in the opposite direction to give the feeling of real movement. The movement of the background is determined by dividing the number of cels in the cycle into the distance of two strides. In other words if the cycle takes 32 frames to make a complete cycle, and the distance of two strides is two inches, then each time you photograph a single frame the background should be moved 1/16". On a running cycle the background movement should be increased by 50%. A speeding car may require a much greater movement of background.

The verticle movement background should be 16 1/2" wide by about three feet tall. It is usually used where a great deal of verticle movement is desired, such as jumping



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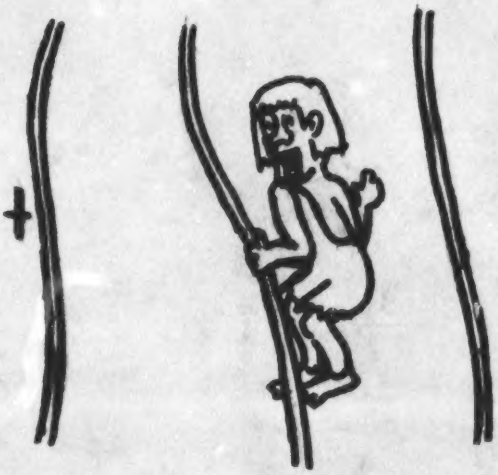

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off of a building or mountain cliff. It may also be used for movement over roads as seen from the air.

The animated backgrounds with slight changes on each to give the impression of side objects moving toward the front. A reversal of the order will give the reverse impression.

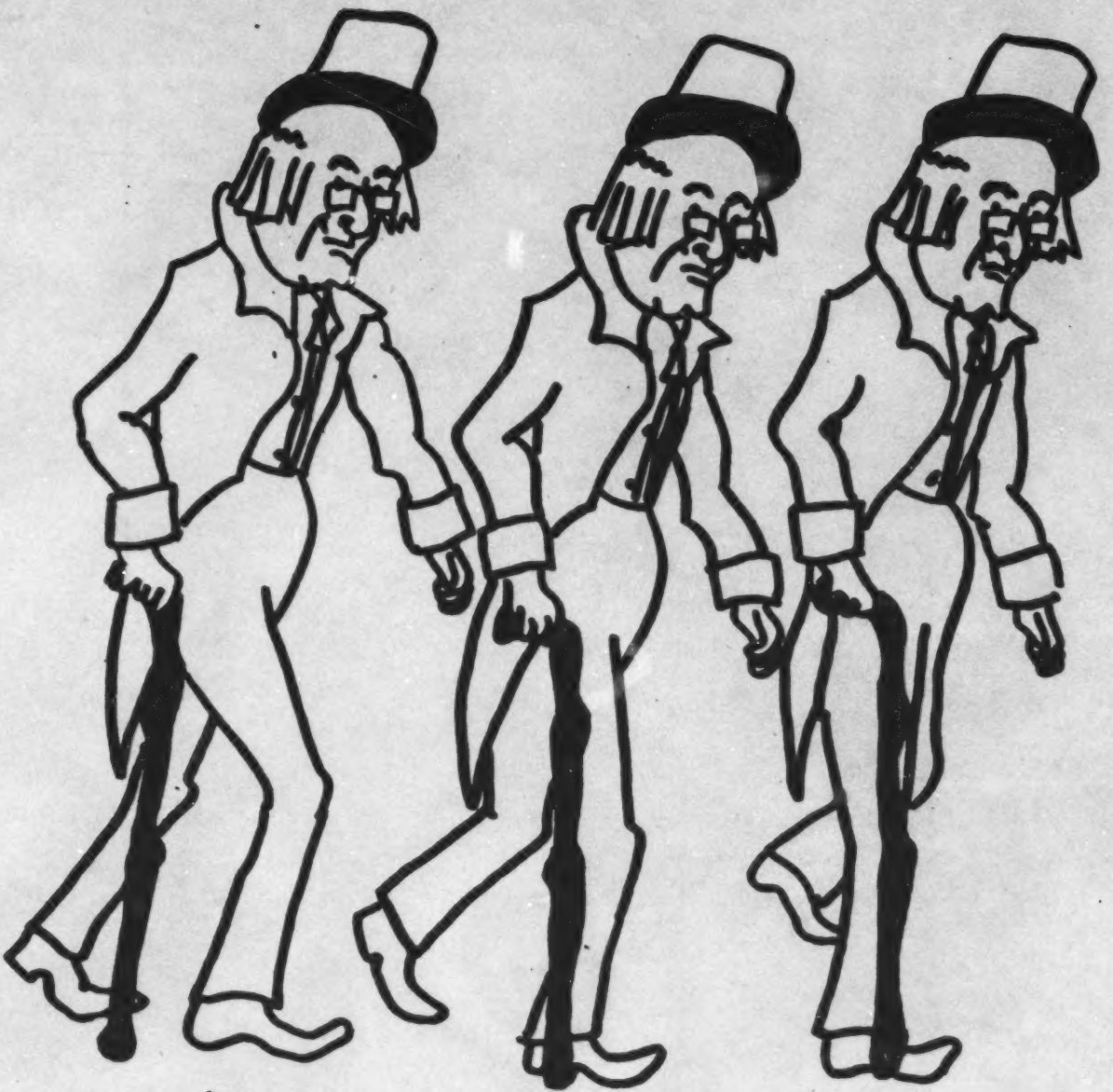
Many times you may want to add a foreground to your backgrounds, in order to achieve a depth of field or perspective. This can be done easily by attaching it to the filming photo stand.

Title and credit cards should be prepared for each cartoon film. The title and credit cards should appear near the first of the film. All lettering should be neatly done, centered, and with enough margin to allow for parallex problems during filming. Be sure to allow enough film time for the audience to read what the card says. Title cards and credit cards may be done by the background artists.

For a further study of cartoon backgrounds I would like to suggest the book by Christopher Finch called "The Art of Walt Disney."

XI. HOW DO WE ANIMATE THE LIP MOVEMENT?

Many times it is easier to control the animated movements of different characters by placing them on different cels then stacking the cels during photography. The same method may be employed in the animation of the lip movements.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In other words, you may choose to animate the body of a character seperate of the head and then use only four different cels of the head which will contain the lip changes from A, completely closed, to D which is the widest mouth opening. The heads complete with lip changes will stack over the body and be changed during photography according to the script. Only one head will be stacked, at a time, over its body during the filming process.

You may choose to make the body of your character complete except for the lips, and then put only the lip changes on four cels to stack over the character.

Which ever method you choose to use the important thing to remember is to follow carefully the script during photography to obtain good animated lip movements.

XII. HOW DO WE PHOTOGRAPH OUR CARTOON?

Once the art work is complete, you are then ready to start photographing your cartoon. You need to set up some type of copy stand for your camera, copy, and lights. Check your camera first, to find out the closest you may get to your object. For many of the Super 8 cameras this distance may be five feet, while on 16 mm cameras you may be able to get in as close as 2 1/2 feet.

You may choose to buy or build a copy stand, as it suits your needs. We started our filming by mounting the camera on the wall attached to a small metal bracket and

did our filming on the floor. We used this method for six years until we finally built a copy stand to fit our needs.

Your photo lights should be mounted at a 45 degree angle to your copy (art work) and may be a single 250 watt flood light. It should be mounted about 2 1/2 feet from the copy. Mounted at a 45 degree angle to the copy, there is little chance of reflection of the photo light into the camera. To cut down on undersirable reflections on the cels, it is best to cut off all other light sources.

Next, stack a background and a cel on the copy board and focus the camera on the outer edges or perimeter of the cel. Once you have zoomed in on the full cel, then zoom in a little further until you have the 8" X 10" portion of the cel in full view. Be sure you have set the focus on the proper distance and lock in tightly the camera in its position. Mark carefully the position of the cel and background so that all filming will continue to be in register. If you are working with a 16 mm camera much of the problem of obtaining the required distance of the camera from the copy should be worked out before starting the process described above. A zoom lens is most desirable in obtaining a good copy register.

Once the camera light and cel alignment is assured, then actual photography may begin. According to the script,

each cel is photographed in its order of succession. If double framing has been planned the photographer will take two pictures or frames in succession of the animation. This is a hand process of placing the cels up one at a time and camera man taking two pictures and then placing another cel in place and repeating the process. Some cameras have a shutter control for single frames while some cameras will require a shutter release.

Most Super 8 cameras have an automatic light exposure, but if your camera does not, be sure to get a light reading with an exposure meter before beginning to film. Check with an expert in photography if you have any problems other than those covered here.

All of this filming process is by hand and, therefore, it is very important that all hands and heads of the photographers are out of the view of the camera before any pictures are taken.

Only the director should be the one to say when the camera man should take a picture. His instructions should be given, "Ready camera one?" (If all is ready then continue) "Take two." (The number will indicate the number of frames necessary.)

Each year I have set up a photography team each hour of our school day, complete with a director, who understands the script and the animation film process. This is done

when all of the art work is complete. It usually takes no more than eight to ten school days to complete the filming using the six teams.

XIII. HOW DO WE EDIT THE FILM?

After the film is processed, it is ready to be edited and spliced. The film should be checked carefully with an eye towards quality. A film editor will help a great deal in viewing the film and may be purchased at most any photo shop. If you are using 16 mm film you may be able to hold the film up to the light and use the projector for details. The edited film should not show any filming mistakes, and should follow the script as closely as possible. If an area of the film is not up to standards, then it should be re-filmed before the sound is added. Super 8 splicers and splice tapes are available at most camera departments. These splice tapes give a good quality splice and will not weaken the film. It is best to keep splices to a minimum.

XIV. HOW DO YOU ADD SOUND TO THE FILM?

The sound for the film may be added in one of several ways. Most important is for you to obtain the use of a magnetic sound projector which will allow you to record through the projector onto the film's magnetic sound track. Not all magnetic sound track projectors are equiped with the recording device.

If you are taking the sound off of a record then extension jacks may be used. If you are unable to find such equipment then you may record using the microphone placed next to the speaker of the record player. Be sure to check the sound level.

Voice parts, if there are any, should be assigned according to voice quality, and the nature of the character, while sound effects should be innovated for the situation, such as: dropping waste cans, tooting horns, ringing bells, and any other methods necessary to produce the desired effects. If your sound is not already recorded then you may desire to use the above methods during the time you project the film and add the sound at the same time. This is especially a good method if you have written your own story.

All heaters, motors, and other equipment should be turned off during the recording. It may be necessary to place the projector in one room and project through an open door into another room. The sound recording gives a finished cartoon film.

Good Luck!

Learning Objectives

I. What is Animation?

The purpose of this chapter is to acquaint the student or class with what animation is and to give a brief introduction to animation.

II. Where do We Begin?

The purpose of this chapter is for the student or class to think and plan the cartoon film with the audience and objectives well in mind.

III. How Do You Write an Animation Script?

The purpose of this chapter is for the student or class to work and to think in terms of the elements of a good script for animation.

IV. How Do You Get The Timing Right?

The purpose of this chapter is to give the student or class good workable methods for obtaining sound and visual synchronization for their film.

V. What Kind of Camera And Projector Do I Need?

The purpose of this chapter is to guide the student or class in the selection of their camera and projector necessary for the filming, recording, and play-back of their film.

VI. How Do You Develop A Cartoon Character Model Sheet?

The purpose of this chapter is to direct the student or class in developing characters to fit the script, and in preparing a model sheet for standardization of the characters.

VII. How Do We Begin The Work?

The purpose of this chapter is to aid the class or student in the selection of materials, the job demands of the film, and the assignments.

VIII. How Can We Be Sure Of The Animation?

The purpose of this chapers is to provide the student or class with methods, tables, guides, and student made equipment for visually checking animation before drawing on cels.

IX. How Do We Keep Track Of All The Cels?

The purpose of this chapter for the student or class is to stress the need of a filing system for all animation and to provide a workable system for their use.

X. What Are The Different Kinds of Backgrounds?

The purpose of this chapter for the student or class is to provide an understanding of the types of backgrounds and scenes available for their cartoon film and how to use them.

XI. How Do We Animate The Lip Movement?

The purpose of this chapter for the student or class is to understand various methods available of lip movement and to apply this to their cartoon production.

XII. How Do We Photograph Our Cartoon?

The purpose of this chapter for the student or class is to provide workable low cost quality filming methods for the filming of their cartoon movie.

XIII. How Do We Edit The Film?

The purpose of this chapter for the student or class is to provide methods of editing their film and to stress the importance of quality.

XIV. How Do You Add Sound To The Film?

The purpose of this chapter for the student or class is to provide workable methods of adding sound to their edited cartoon film.

Chapter Review

I. What is Animation?

1. What would be a good definition of animation, according to Webster, which would refer to the overall process of animation?

2. What would be a good definition of animation, according to Webster, which would refer to the drawing of a character in a sequence of movements?

3. Name two devices for viewing animation in use before the motion picture projector.

4. To give the impression of a single picture which has movement, what basic idea was employed?

5. What elements must the design or character animated retain in the drawing to drawing sequence?

II. Where Do We Begin?

1. What concept should be considered first in beginning a cartoon movie?

2. List three different questions to be answered before starting on the script.

3. To what can a story board be compared?

4. Name four different types of cartoon films.

5. What type of cartoon is enjoyed most by high school students?

6. If you decide to animate a popular record what course of action is advised?

7. Name three advantages of using a popular recording as the basis for your film.

8. If you decide to write your own script what should be your procedure?

III. How Do You Write An Animation Script?

1. Name the three verticle divisions of a good working script.

2. Name the horizontal divisions.

3. What basicly are scenes?

4. If you are writing your own story what other factors (other than those mentioned above) should you be concerned with?

5. What is the most necessary ingredient in animation?

6. What element of animation will help to reduce the amount of animation?

7. What should be the blue-print for all art and filming productions?

8. What should be done with the script in its final form?

9. How is lip movement determined?

10. How should the lip movement be recorded on the script?

IV. How Do You Get The Timing Right?

1. When writing your own story what synchronization is critical?

2. What is considered to be a regular pace of normal speech?

3. If you are trying to match the video to a sound recording, what is critical?

4. What is the first step in obtaining a working script for a recording?

5. What are the next steps in obtaining the time divisions in your script?

6. How may you obtain the number of frames for each word in a one second space?

7. How do you count long words and pauses in determining the number of frames for each word or pause?

8. What should the final script indicate, in relationship to words and action?

9. Describe another method for dividing sound into one second intervals.

10. Using a universal lead sound test film, what should you obtain on the script?

V. What Kind of Camera And Projector Do I Need?

1. What two main factors determine your choice of camera and projector?

2. What features found on Super 8 equipment help to give a more professional look to the finished film?

3. If you decide to use Super 8, then what must your camera be able to do?

4. What is sound stripping?

5. How and when do you record the sound?

6. What is the most important thing to remember in purchasing a Super 8 sound projector?

VI. How Do You Develop A Cartoon Character Model Sheet?

1. Why should model sheets be developed early?
2. What must cartoon characters do first?
3. Describe the cute cartoon character.
4. Describe the hero-heroine cartoon character.
5. Describe the comedy team cartoon characters.
7. What should be included in the model sheets?

VII. How Do We Begin the Work?

1. What three things are needed to begin the work?
2. What should be purchased ahead of time?
3. What are cels?
4. Into what cel-size is considered the best size to cut the large sheets of acetate?
5. On what should the pencil animation drawings be done?
6. Make a list of the materials required for the art work in your cartoon movie.
7. On what side of the cel should you paint?
8. How may acrylic colors and mixed acrylic colors be sealed to insure their not drying out?
9. When is it important to maintain the same degree of color in a set of animation?
10. What makes a good director?
11. What makes a good background artist?
12. What demands are placed upon the animator?

13. What makes a good inker?

14. What are the requirements of a good cel painter?

15. Who serves as photographers?

16. Assuming you are working with 15 people, give the breakdown of the assignments.

17. How should assignment be listed on an assignment sheet?

18. Why should the animators and background artist work together closely?

19. While the cel is cut to 13" X 16 1/2" size, what part of this area will be photographed?

20. For what purpose is the extra cel size on the sides, top, and bottom?

VIII. How Can We Be Sure Of The Animation?

1. What is the animator's concern about his animation drawings?

2. Describe the ZOETROPE.

3. Build a zoetrope, as described, for use with 12 drawings of an animation cycle.

4. Use the animation table as a guide and draw an animation cycle of 12 drawings to be viewed on the zoetrope you have made.

5. What is double frame photography and what does this mean to the animator?

IX. How Do We Deep Track of All the Cels?

1. What must be developed early to keep track of the drawings or cels?

2. How should each drawing be labled?
3. How would the inkers label the cels?
4. How should the painters label the cels?
5. How should the cels be placed in folders?

X. What Are The Different Kinds of Backgrounds?

1. Name five types of backgrounds.
2. What is the difference between a scene and a background?
3. What is meant by limited animation?
4. How large may scenes be?
5. How does the photographer use a scene?
6. Backgrounds enhance the animation by providing what?
7. What is a stationary background?
8. What is a horizontal background?
9. What are the dimensions of a horizontal background?
10. Using the horizontal background how is the movement of the background determined?
11. On a running cycle how much should the movement of the background be increasdd?
12. Describe the verticle background and its purpose.
13. Describe the animated backgrounds and their purpose.
14. How may you add a foreground?
15. Where, in your film, should title and credit cards appear?

XI. How Do We Animate the Lip Movement?

1. What does it mean to stack cels for lip movement?
2. How do you indicate lip changes on the script?

3. What is another method for animating lip movements?

4. What is the important thing to remember during photography about lip movements?

XII. How Do We Photograph Our Cartoon?

1. When do you start photographing the cartoon movie?

2. What do you need in the way of equipment?

3. At what angle should your photo-flood light be mounted to your art work?

4. What is copy?

5. How do you cut down on undesirable reflections?

6. How do you check the camera's area of view in relationship to your background and cel?

7. According to your script how is each cel photgraphed?

8. Describe the hand process of animation photgraphy.

9. What must you check to be sure they are out of view of the camera before pictures are taken?

10. Who should be the only person to say when the camera man should take a picture?

XIII. How Do We Edit The Film?

1. When does editing and splicing of the film begin?

2. What piece of equipment will help a great deal in viewing the film?

3. Besides not showing any filming mistakes, what should the film follow as closely as possible ?

4. If any area of the film is not up to standards, what should be done before the sound is added?

5. What is a good method for splicing Super 8 film?

XIV. How Do You Add Sound To The Film?

1. What type of projector is necessary to allow you to record sound onto the film's magnetic sound track?

2. What may be used when taking the sound off a record?

3. If you must use the microphone instead, where should the microphone be placed for recording?

4. When recording the sound, what should you be sure to check?

5. How should voice parts be assigned?

6. How should sound effects be made?

7. What should you turn off during the sound recording?

8. In order to cut down on the noise level what may you do with the projector during the recording?